IS 3578 (1985): Dental Gold Alloy Wire [MTD 10: Precious Metals]

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Indian Standard

SPECIFICATION FOR DENTAL GOLD ALLOY WIRE

(First Revision)

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard
SPECIFICATION FOR DENTAL GOLD ALLOY WIRE

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 31 January 1985, after the draft finalized by the Precious Metals Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 In modern dentistry, wire is the principal form in which wrought metal is used. Gold alloys used for such wires are complex alloys containing gold, platinum, palladium, silver, copper, zinc and sometimes nickel. Gold alloy wires are occasionally employed for the construction of clasps and are also used for the construction of orthodontic appliances. In order that the wire should perform good service, it is necessary that it should have proper composition and tensile properties.

0.2.1 Two types of alloys for making dental wire have been specified. Typical compositions of gold alloys along with their physical properties have been included in Appendix A. Fusion temperature ranges have also been indicated for these typical alloys.

0.3 The standard was first published in 1966. In this revision the following modifications have been made:

a) MKS units have been changed to SI units, and

b) Appendix C giving method for chemical analysis have been deleted. A reference of IS : 6890 (Part 1)-1973* and IS : 6890 (Part 2)-1973† have been made in **12.2.**

0.4 Since maximum advantage may be taken only when the wire is in the annealed condition, this condition alone has been specified. A clause on sizes of wire generally used in dental practice has been included and it is expected that as a result of the recommendations made in this standard, the sizes will be restricted to a reasonable number.

*Methods for chemical analysis of dental gold alloys: Part 1 Determination of gold silver, copper, palladium and platinum.

†Methods for chemical analysis of dental gold alloys: Part 2 Determination of nickel and zinc.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard prescribes requirements of gold alloy wire used in the fabrication of orthodontic and prosthetic appliances.

2. TYPES

2.1 The gold alloy wire covered in this standard shall be of two types, namely, Type 1 and Type 2.

3. SUPPLY OF MATERIAL

3.1 General requirements relating to the supply of material shall conform to IS : 1387-1967†.

4. FREEDOM FROM DEFECTS

4.1 The wire shall be free from imperfections which have a deleterious effect on the appearance and serviceability.

5. CHEMICAL COMPOSITION

5.1 The chemical composition of the wire shall be in accordance with Table 1.

6. CONDITION

6.1 Unless otherwise specified by the purchaser, dental gold alloy wire shall be supplied in the annealed condition.

7. TENSILE REQUIREMENTS

7.1 The tensile properties of two test specimens, when determined in accordance with the method given in Appendix B, shall conform to the requirements specified in Table 2

*Rules for rounding off numerical values (*revised*).
†General requirements for the supply of metallurgical materials (*first revision*).

TABLE 1 CHEMICAL COMPOSITION OF DENTAL GOLD ALLOY WIRE

(*Clause* 5.1)

METALS	MASS, PERCENT	
	Type 1	Type 2
Gold and platinum group metals (total)	75 *Min*	65 *Min*
Gold	25 *Min*	25 *Min*
Silver	25 *Max*	10 to 25
Copper, nickel and zinc	25 *Max*	25 *Max*

NOTE — Of the platinum group metals, platinum, palladium and traces of iridium are generally present in the dental gold alloy compositions.

TABLE 2 TENSILE PROPERTIES OF DENTAL GOLD ALLOY WIRE

(*Clause* 7.1)

0·1 PERCENT PROOF STRESS	*TENSILE STRENGTH	†ELONGATION ON 50 mm GAUGE LENGTH, PERCENT
Min	*Min*	*Min*
MPa	MPa	
625	930	15

NOTE — 1 MPa = 0·102 kgf/mm^2.

*This property relates to hardened condition of the wire.

†For elongation measurement, wire shall be annealed in accordance with the manufacturer's instruction (*see* also **B-3.1**).

8. SIZES OF WIRE

8.1 The nominal wire size shall be designated by the diameter expressed in millimetres. The dimension of the wire shall be subject to the tolerance of ± 3 percent on the nominal size. The range of the nominal sizes should be taken from an arithmetic series of dimensions starting from 0·5 mm and having a common difference of 0·1 mm.

NOTE — Subsequent consideration will be given to the introduction of the preferred range of sizes when further experience has been gained in the use of sizes specified above.

9. MARKING

9.1 The material or its container shall be legibly marked with the type of the alloy; size; mass of the contents; and the name, initials or trademark of the manufacturer.

9.1.1 The material may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

10. PACKING

10.1 The material shall be packed in such a manner as to prevent damage during transport.

11. SAMPLING

11.1 The purchaser for his representative may, if he so desires, select ten straight pieces of round wire 30 cm long delivered in the original unopened package or packages. This shall constitute the sample for testing.

11.2 Visual inspection shall be used in determining compliance with the requirements specified in **4**.

11.3 In case a test specimen fails to meet the physical requirements, two more specimens shall be tested. The material shall be considered satisfactory only if both retest specimens satisfy the requirements.

11.4 The sample for chemical analysis shall consist of a composite sample of ten grams of each lot of 200 g or fraction thereof. Sample for this purpose shall be taken by shearing or clipping pieces from the entire cross-sections, remelting in a clean container at a temperature slightly above the melting range mixing thoroughly and pouring into cold mould of convenient size. The sample so prepared shall be milled, drilled or sawed in such a manner as to represent the entire cross-section. Saw, drill or any other tool used shall be thoroughly clean and no lubricant shall be used in the operation.

12. TESTING

12.1 Tensile Testing — For the purpose of tensile testing (*see* Appendix B), test specimen of the dental gold alloy wire shall be of round cross-section of $1{\cdot}0 \pm 0{\cdot}2$ mm diameter. The proof stress and percentage elongation shall be determined on a gauge length of 50 mm. The test specimens shall be heat-treated before testing. This shall be done by placing the specimens in a furnace at 810°C for Type 1 alloys and 700°C for Type 2 alloys for ten minutes and immediately quenching in water at room temperature.

12.2 Chemical Composition — The chemical composition (*see* Table 1) shall be determined either by the method specified in IS : 6890 (Part 1)-1973* and IS : 6890 (Part 2)-1975† or any other established instrumental/chemical method. In case of dispute the procedure in the latest adition of IS : 6890 (Part 1) and IS : 6890 (Part 2) for chemical analysis shall be the referee methods.

APPENDIX A

(*Clause* 0.2.1)

TYPICAL COMPOSITIONS AND PHYSICAL PROPERTIES OF DENTAL GOLD ALLOY WIRE

(For information)

A-1. COMPOSITION

A-1.1 Typical compositions of dental gold alloy wire are given in Table 3.

TABLE 3 CHEMICAL COMPOSITION OF DENTAL GOLD ALLOY WIRE

Type	Percent							Fusion Temperature °C
	Gold	Platinum	Palladium	Silver	Copper	Nickel	Zinc	
1.	25-30	40-50	25-30	—	—	—	—	1 500-1530
2.	54-60	14-18	1-8	7-11	11-14	0-1	0-2	1 000-1100
3.	62-64	7-13	0-16	9-16	7-14	0-2	0-1	945-1020
4.	64-70	2-7	0-5	9-15	12-18	0-2	0-1	900-930

A-2. PHYSICAL PROPERTIES

A-2.1 The physical properties of dental gold alloy wire of the compositions given in Table 3 are given in Table 4 for information.

TABLE 4 PHYSICAL PROPERTIES OF DENTAL GOLD ALLOY WIRE

Type	0·1 Percent Proof Stress MPa	Tensile Strength MPa	Elongation 50 mm Gauge Length, Percent		Hardness BHW	
			Soft	Hard	Soft	Hard
1.	550-1 030	855-1 240	—	—	200-245	—
2.	490-695	755-895	12-22	5-10	150-190	240-285
3.	375-550	580-685	14-16	2-8	166-195	240-295
4.	365-500	560-825	14-20	1-3	135-200	230-290

*Methods of chemical analysis of dental gold alloys: Part 1 Gold, silver, copper, palladium and platinum.

†Methods of chemical analysis of dental gold alloys: Part 2 Determination of nickel and zinc.

APPENDIX B

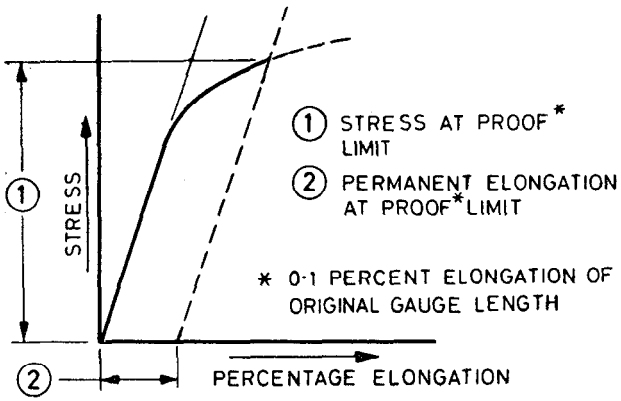
(*Clauses* 7.1 *and* 12.1)

METHOD FOR DETERMINATION OF TENSILE PROPERTIES OF DENTAL GOLD ALLOY WIRE

B-1. DETERMINATION OF 0·1 PERCENT PROOF STRESS

B-1.1 Increasing loads should be applied successively to the hardened specimen and maintained in each case for ten seconds. After removal of each load, the permanent elongation which the specimen has taken should be measured. The test should be stopped when the elongation exceeds 0·1 percent.

B-1.2 An accurate curve should be plotted by taking loads as ordinates and corresponding elongation as abscissae. A straight line should be drawn on the graph parallel to the straight part of the curve at a distance from the straight part measured along the given axis of the abscissae equal to 0·1 percent of the initial gauge length (Fig. 1). The desired stress will correspond to the point of intersection of straight line and the curve.



*0·1 percent elongation of origional gauge length.

FIG. 1 STRESS PERCENTAGE ELONGATION CURVE

B-2. TENSILE STRENGTH

B-2.1 After determining the proof stress, the specimen shall be replaced at the same rate as in **B-1.1** until rupture occurs. The determined value for tensile strength shall be recorded to the nearest 100 N.

B-3. ELONGATION

B-3.1 Elongation shall be determined on the specimens of the alloy that have been annealed by heat treatment in accordance with the manufacturer's instructions. Should a test piece break outside the gauge length resulting in an elongation below the value specified, the test piece may be discarded and another test made from a fresh test piece.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2